APPENDIX E
Economic Analysis

RECONNAISSANCE REPORT
SAN JOAQUIN RIVER MAINSTEM AND TRIBUTARIES

ECONOMIC ANALYSIS
JANUARY 1992

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Introduction

The analysis is based upon a 50-year project life, October 1992 prices, 8-1/2 percent interest rate, and existing levels of development. The following narrative describes the methodology used to determine average annual equivalent without project damages, with project damages, and benefits. Two alternatives were analyzed: a full diversion area and a partial diversion area. The full diversion alternative designates 14 areas along the San Joaquin River in reach 3 as storage areas for channel overflow for the protection of life and property. The second alternative, a partial diversion area, designates nine areas along the river in reach 3 to be used as storage areas.

Flood Plain Description

The economic evaluation began with an inventory of the area within the 100-year flood plain. The flood plain was divided into six reaches and covers the area along the San Joaquin River from Stockton going south to Fresno, California see (Figure 1). Reach 1 was not included in the economic analysis because the full diversion and partial diversion alternatives concentrate on the San Joaquin River Mainstem. The area of the San Joaquin River in Reach 1 is considered to be a tributary to the mainstem. The remaining flood plain reaches, 2 - 6, were analyzed for the 100-year flood event except for reach 2 in which the 50-year historical event was also analyzed. The area within the flood plain is predominately agricultural. Agriculture grown in the flood plain are alfalfa, almonds, apples, barley, beans, broccoli,cauliflower, corn, cotton, oat, peaches, plums, sugar beets, tomatoes, vineyards, and wheat. Residential, commercial, public, and industrial buildings are subject to flooding from the San Joaquin River. Other notable structures in the flood plain include a dairy farm, a tomato plant, the San Joaquin River Club (hunting club), and a prison (Deuel Vocational Institution).

Damageable Structures & Present Property Values

The structure inventory was separated by land use categories and consist of the following: (1) single family residential; (2) multiple family residential; (3) mobile homes; (4) farm buildings, (5) public; (6) commercial; and (7) industrial. The value of damageable property is presented in Tables 1A - 5A. In addition, the without project damages are shown for comparison purposes in tables 1B - 5B, and a more detailed analysis is discussed later in the

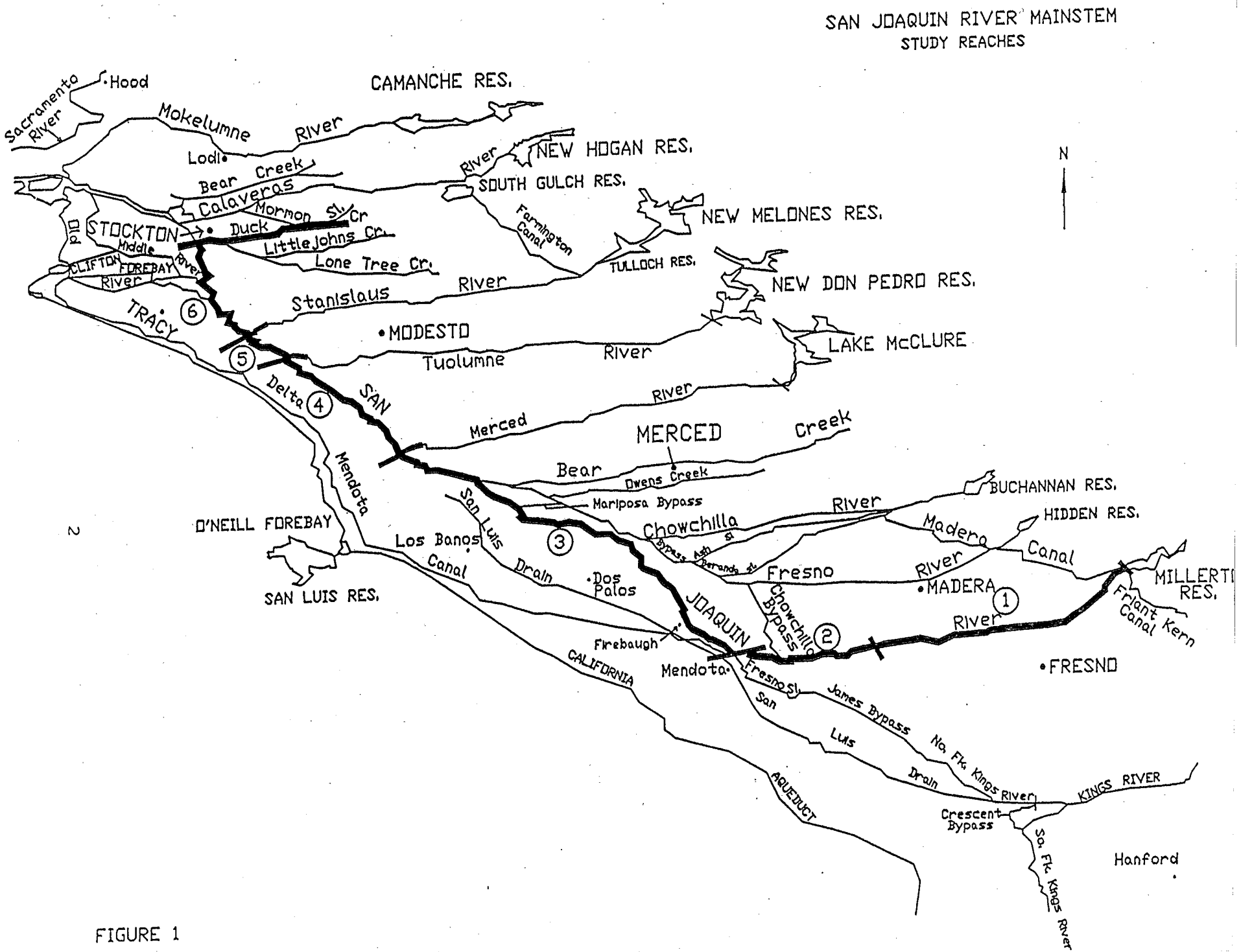

FIGURE 1

TABLE 1a
Reach 2
San Joaquin River Mainstem
Total Value of Damageable Property
($1,000)

Land Use Category	50–Year		100–Year
Single–Family Structure	0		942
Single–Family Content	0		471
Public Structure	0		50,000
Public Content	0		22,500
Barn Structure	0		455
Barn Content	0		496
Total :	0		74,864

TABLE 1b
Reach 2
Existing Damages for the San Joaquin River Mainstem
Damages due to Rainfall and Snowmelt
($1,000)

Land Use Category	50–Year		100–Year
Single–Family Structure	0		298
Single–Family Content	0		197
Public Structure	0		16,153
Public Content	0		9,870
Barn Structure	0		147
Barn Content	0		217
Agriculture	462		5,405
Emergency Costs	0		284
Road Damages	29		589
Automobile Damages	0		367
Total :	491		33,527

TABLE 2a
Reach 3
San Joaquin River Mainstem
Total Value of Damageable Property
($1,000)

Land Use Category	100–Year
Single Family Structure	16,308
Single Family Content	8,154
Multi–Residential Structure	289
Multi–Residential Content	145
Mobile Home Structure	81
Mobile Home Content	40
Commercial Structure & Content	1,439
Industrial Structure	24,423
Industrial Content	22,225
Barn Structure	5,576
Barn Content	6,078
Total :	84,758

TABLE 2b
Reach 3
Existing Damages for the San Joaquin River Mainstem
Damages due to Rainfall and Snowmelt
($1,000)

Land Use Category	100–Year
Single Family Structure	8,242
Single Family Content	4,679
Multi–Residential Structure	146
Multi–Residential Content	83
Mobile Home Structure	28
Mobile Home Content	34
Commercial Structure & Content	790
Industrial Structure	12,654
Industrial Content	13,425
Barn Structure	2,889
Barn Content	3,672
Agriculture	60,909
Emergency Costs	4,504
Road Damages	8,482
Automobile Damages	5,941
Total :	126,478

TABLE 3a
Reach 4
San Joaquin River Mainstem
Total Value of Damageable Property
($1,000)

Land Use Category	100–Year
Single Family Structure	14685
Single Family Content	7343
Multi–Residential Structure	482
Multi–Residential Content	241
Mobile Home Structure	901
Mobile Home Content	451
Commercial Structure & Content	2834
Industrial Structure	414
Industrial Content	377
Barn Structure	2582
Barn Content	2814
Total :	33,124

TABLE 3b
Reach 4
Existing Damages for the San Joaquin River Mainstem
Damages due to Rainfall and Snowmelt
($1,000)

Land Use Category	100–Year
Single Family Structure	6788
Single Family Content	3770
Multi–Residential Structure	218
Multi–Residential Content	124
Mobile Home Structure	284
Mobile Home Content	345
Commercial Structure & Content	1381
Industrial Structure	129
Industrial Content	204
Barn Structure	1224
Barn Content	1569
Agriculture	7833
Emergency Costs	3817
Road Damages	1212
Automobile Damages	4363
Total :	33,261

TABLE 4a
Reach 5
San Joaquin River Mainstem
Total Value of Damageable Property
($1,000)

Land Use Category	100–Year
Single–Family Structure	916
Single–Family Content	458
Barn Structure	429
Barn Content	215
Total :	2,018

TABLE 4b
Reach 5
Existing Damages for the San Joaquin River Mainstem
Damages due to Rainfall and Snowmelt
($1,000)

Land Use Category	100–Year
Single–Family Structure	453
Single–Family Content	257
Barn Structure	218
Barn Content	127
Agriculture	4054
Emergency Costs	145
Road Damages	916
Automobile Damages	374
Total :	6,544

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TABLE 5a
Reach 6
San Joaquin River Mainstem
Total Value of Damageable Property
($1,000)

Land Use Category	100–Year
Single Family Structure	11147
Single Family Content	5573
Mobile Home Structure	1043
Mobile Home Content	522
Public Structure	200147
Public Content	90066
Commercial Structure & Content	293
Barn Structure	1192
Barn Content	1299
Total :	311,282

TABLE 5b
Reach 6
Existing Damages for the San Joaquin River Mainstem
Damages due to Rainfall and Snowmelt
($1,000)

Land Use Category	100–Year
Single Family Structure	1158
Single Family Content	2814
Mobile Home Structure	312
Mobile Home Content	212
Public Structure	86863
Public Content	47148
Commercial Structure & Content	145
Barn Structure	533
Barn Content	726
Agriculture	10819
Emergency Costs	3305
Road Damages	1282
Automobile Damages	4285
Total :	159,602

report. The value of each structure was estimated at replacement cost less depreciation. Replacement cost is the cost of physically replacing (reconstructing) the structure. Depreciation is that portion of the structure value that is diminished due to wear and age. Estimates of structure value were obtained by interview and Marshall & Swift appraisal handbook. Estimates of depreciation were taken from the Marshall and Swift appraisal handbook depreciation tables, which give the life expectancy of buildings. The amount to depreciate a structure depends on the type of occupancy and the classification of construction. Based upon these tables, a depreciation value was determined for the different types of construction in the flood plain.

Types Of Damages

The types of damages include structure (residential, public, commercial, and industrial) contents, (household items, personal property, furniture, supplies, merchandise, equipment, and fixtures), agriculture, emergency costs, roads and automobiles.

Residential damages are composed of two separate categories: (1) physical damages to dwelling units (single-family, multiple family, and mobile homes); and (2) damages to residential contents including household items and personal property.

Damages to farm buildings include barns, sheds, storage facilities, and their contents.

Commercial damages consist of the structure value of office buildings and retail space and content value, which includes furniture, supplies, merchandise, and other items used in the conduct of business, trade, service, and entertainment.

Public damages are tangible damages associated with the inundation to hospitals, churches, libraries, schools, and Federal, State, and local government facilities (including equipment and furnishings). Parks, bridges, highways, and roads were considered public.

Industrial damages include facilities that take raw materials and manufacture or fabricate new commodities. The loss and destruction of industrial properties from inundation consist of three categories: (1) fixtures and equipment; (2) inventory; and (3) structure.

Historical agricultural damages were used to calculate the damages associated with inundation to crops, orchards, and vineyards and the clean-up cost associated with flooding. Historical flood events were used from the 1955, 1958, 1964-1965, 1966-1967, and 1968-1969 floods. The historical damages were updated to October 1992 prices and a weighted average was then determined. This was estimated to be approximately $200 per acre. Several sources were contacted to obtain a better dollar damage figure for agriculture; since the latest historical record used was 1968-1969. Agencies contacted were the Department of Water Resources, Agriculture Cooperative Extension, Soil Conservation Service, San Joaquin Levee District, and the Central Irrigation District. Basically, during the winter months, farmers keep the ground in the flood plain in native pasture or plant wheat, oats, and barley, except for vineyards and orchards in the area. After discussions with the aforementioned it was apparent that a more detailed analysis was needed, but for purposes of this report the $200 per acre value was used.

Automobile damages occurred to those vehicles located at private homes in the flood plains.

Emergency costs are the costs that are incurred during flood emergencies for evacuation and reoccupation, flood fighting, disaster relief, and increased police and fire protection. A cost of $35 per person day and duration of 60 days was used in this analysis.

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Depth-Damage Relationships

Depth-damage relationships describe the probable damages that would occur under different depths of flooding conditions, either as a percentage of the total value of damageable property or as the probable loss expected. The relationships used in this analysis were based on 1988 Federal Insurance Administration depth-damage curves and depth damage curves from other government agencies. These relationships were developed for individual land use categories and type, age, and condition of the structures, foundation heights, types of contents, and depths of flooding. The similarity in types of construction between structures found in the San Joaquin River flood plain and those encountered in previous District studies, was the basis for using these depth-damage curves. Verification of these curves has been undertaken in other District studies, and they have been found to be appropriate.

Damage-Flow Relationships

Damage-flow relationships describe the probable damages expected for streamflows at various frequencies. They are derived by estimating the probable flood damages of several hypothetical floods of given streamflows. Intermediate damage points are interploted from these estimates on the basis of proportionate changes in the magnitude of streamflows. The probable flood damages that would result from a particular flow are estimated by describing the flood plain area associated with that flow, inventorying this area by damage category and depth of flooding, and applying the appropriate depth-damage relationships for each category. Probable damages were determined for flood events in each reach.

Average Annual Damages

Without Project Flood Damages

Probable average annual damages without the proposed project were estimated for the present year, the base year, and annually throughout the study period and were based on existing conditions. The probable average annual damages for the full diversion area alternative and the partial diversion area alternative are presented in Tables 6 and 7.

With Project Flood Damages

The average annual with project damages are those damages which a proposed project does not eliminate. The with project damages for the full diversion area alternative eliminate flooding from all of the reaches and are presented in Table 6. The partial diversion area alternative eliminates flooding downstream from reach 3. The partial diversion area alternative does not

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provide any flood protection upstream in reach 2; therefore, the without and with project damages are identical, and no benefits can be claimed from reach 2 for the proposed project. The with project damages for the partial diversion area are presented in Table 7.

Benefit Evaluation

Benefits that accrue from the evaluation of flood control projects include inundation reduction benefits, savings in flood proofing cost, location benefits, and flood insurance administration program benefits. Since only existing conditions were evaluated, there are no savings in flood proofing costs or location benefits. Because the project alternatives do not provide 100-year level of protection there were no Flood Insurance Administration costs. Inundation reduction benefits for the selected alternatives, full diversion area and the partial diversion area were evaluated by comparing the with project damages and the without project damages. Flood damage reduction benefits are the difference between equivalent average annual flood losses without the project and the residual annual losses with the project. The average annual benefits for the selected alternatives are presented in Tables 6 and 7.

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Table 6
Full Diversion Area
Average Annual Equivalent Damages & Benefits
October 1992 Prices, 8 1/2 % Interest Rate

	Without Project Damages	With Project Damages	Benefits
Reach 2			
Rainfall	766,000	756,000	10,000
Snowmelt	183,000	172,000	11,000
Reach 3			
Rainfall	3,024,000	2,172,000	852,000
Snowmelt	1,100,000	495,000	605,000
Reach 4			
Rainfall	1,101,000	954,000	147,000
Snowmelt	358,000	129,000	229,000
Reach 5			
Rainfall	191,000	151,000	40,000
Snowmelt	24,000	21,000	3,000
Reach 6			
Rainfall	3,378,000	3,220,000	158,000
Snowmelt	56,000	44,000	12,000
Total:	10,181,000	8,114,000	2,067,000

Table 7
Partial Diversion Area
Average Annual Equivalent Damages & Benefits
October 1992 Prices, 8 1/2 % Interest Rate

	Without Project Damages	With Project Damages	Benefits
Reach 2			
Rainfall	766,000	766,000	–
Snowmelt	183,000	183,000	–
Reach 3			
Rainfall	3,024,000	2,557,000	467,000
Snowmelt	1,100,000	797,000	303,000
Reach 4			
Rainfall	1,101,000	1,020,000	81,000
Snowmelt	358,000	287,000	71,000
Reach 5			
Rainfall	191,000	174,000	17,000
Snowmelt	24,000	21,000	3,000
Reach 6			
Rainfall	3,378,000	3,259,000	119,000
Snowmelt	56,000	44,000	12,000
Total:	10,181,000	9,108,000	1,073,000